

**Evaluation of Region IV
Draft Florida Phosphate Mining Strategy**

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I. Background and Statement of Problem

Phosphate mining and processing activities have resulted in the redistribution of natural radioactivity in approximately 2,150 square miles in central Florida. This redistribution resulted in increased potential for human exposure and environmental risks that were noted in EPA studies conducted in the 1970's. Twenty-one sites within this area were included in the CERCLIS database, and a review of this database by the GAO noted that these sites had not been addressed by EPA.

The South Site Management Branch (SSMB) of EPA Region IV is developing a strategy to assess the human health and environmental radiation risks posed by the sites and to determine if remediation is necessary. To date, the SSMB has conducted a review of data collected by the agency in 1979-1980, prepared a draft briefing in March 2002, and prepared a draft strategy in June 2003. The draft strategy is being reviewed within the agency and has been discussed, in general terms, with environmental radiation officials in the state of Florida.

The challenge in developing the strategy is balancing the assurance of being adequately protective of public health and the environment, the scope of dealing with sites potentially covering over 2,000 square miles, and the costs associated with such an effort, particularly if remediation is required.

The purpose of this evaluation is to perform a critical review of the draft strategy and offer comments and suggestions as appropriate.

II. Current Strategy

The current Region IV strategy on this issue is presented in the document: "Draft, Florida Phosphate Mining Strategy" prepared by the Waste Management Division, South Site Management Branch, June, 2003.

The strategy is divided into two main components:

Enforcement - Lead Approach wherein identified PRPs (mainly for Mandatory Mine Land Category) would develop and implement response actions using an NPL—Equivalent consent agreement approach.

Fund - Lead Approach wherein PRPs are not identified (mainly Non-Mandatory Mine and CERCLIS sites) and the sites are placed on the NPL and remediated by Superfund.

Each of these components treats three general areas in common:

- Site Assessment
- Response Action
- Community Outreach

Site Assessment

Site assessment utilizes a 3-tiered approach with the objective of screening the entire phosphate mining area to identify the areas which demonstrate the greatest present or potential health risk.

The first tier consists of Aerial Measuring System (AMS) helicopter overflights using the UMTRCA ARAR of greater than 20 $\mu\text{R/hr}$ as the primary screening criterion to identify anomalously high contamination areas.

The second tier would further refine the target area by applying the same screening criterion using land-based vehicular and hand-held instrumentation.

The third tier would use additional property-specific screening measurements and sampling to encompass additional UMTRCA - derived ARARs in assessing individual risk, i.e., 20 $\mu\text{R/hr}$ indoor gamma exposure, 5pCi/l SDWA standard for ground water, and 5pCi/gm for soils.

It is stated that the screening levels would form the basis for any response actions, which are described next.

Response Actions

The discussion in this section of the strategy concludes that the primary trigger for a response action would only be: the greater than 20 $\mu\text{R/hr}$ indoor exposure value, and that a secondary trigger would be: greater than 30 pCi/gm in soil, which would be remediated to the 5 pCi/gm UMTRCA ARAR under certain conditions.

Community Outreach

This section recognizes the potential for significant public relations issues, and generally describes an educational approach to allay population anxiety.

III. Evaluation Methodology

A series of meetings, document reviews and telephone conferences were implemented to surface and address the major issues presented by this strategy.

The first meeting was held on August 6, 2003, in SSMB offices in Region IV. Region IV personnel in the Waste Management Division who had developed the strategy convened to discuss the objectives and timetable for the evaluation.

The major objective of this independent evaluation was to apply the historical experience of the evaluators in the Florida phosphate mining area to the current strategy. Specific objectives consisted of a technical review of the strategy and the development of an alternative approach, if appropriate. The evaluation would then be used to brief the Region IV RA, and then, Superfund management at EPA HQ.

Next, four key documents were reviewed in depth:

1. Indoor Radiation Exposure Due to Radium - 226 in Florida Phosphate Lands, EPA 520/4-78-013.
2. Draft - Florida Phosphate Mining Initiative Briefing, EPA, WMD, SSMB, March, 2002.
3. Draft - Florida Phosphate Mining Strategy, EPA, WMD, SSMB, June, 2003.
4. Proposal - Florida Phosphates Mines Aerial Radiological Survey, Bechtel-Nevada, Remote Sensing Laboratory-Nellis, April, 2003.

Telephone discussions were held with State of Florida personnel: Harlan Keaton, Administrator Environmental Radiation Program, and Michael Gilley, Manager, Radon Program, both in the Florida Department of Health, and both historically linked to the Florida phosphate mine issues.

Another telephone conference was conducted with Larry Zajac and Rich Vojtech of Bechtel—which operates the Aerial Measuring System (AMS). This conversation focused on technical issues which surfaced from their proposal to Region IV.

A follow-up telephone conference was held with Brad Jackson, Jon Richards and Mike Stevenson of Region IV to resolve questions arising from review of the two Region IV strategy documents.

A final telephone conversation was held with Chuck Sands at Superfund Headquarters, who was filling-in for Superfund risk and ARAR subject matter experts. Given the depth of detail desired for this discussion, it was decided to postpone this conversation to a later date. The absence of this conversation at this time was not deemed crucial to the completion of the evaluation.

IV. Major Issues Surfaced

1. ARARs—versus—Risk Range

The most obvious and recurring compliance issue in this, as well as other EPA Superfund remediation, is the differing approaches employed by Superfund policy (10E-4 - 10E-6 excess cancer risk) and other agency dose-based criteria. The Region IV strategy does a very good job developing the use of UMTRCA ARARs as both appropriate to this site, and as precedents at other Superfund sites.

There appears to be a significant disconnect, however, when the use of the ARARs as screening tools during site assessment is translated to trigger points during response actions. Screening level ARARs of greater than 20 $\mu\text{R/hr}$ indoor exposure during aerial fly-overs in tier-one, and then greater than 20 $\mu\text{R/hr}$, 5 pCi/gm radium in soil concentration and 5 pCi/l radium in ground water in tier-three become obfuscated in the discussion of response action triggers. Despite assurances during the site assessment section that the same standards would be used for screening and for response actions, the response action section concludes that the greater than 20 $\mu\text{R/hr}$ indoor exposure ARAR

will be the primary trigger criterion, with secondary consideration given to radium in soil concentrations greater than 30 pCi/gm. The selection of 30 pCi/gm seems arbitrary and will likely meet with great resistance from EPA HQ without further justification. Also, the SDWA ARAR of 5 pCi/l in groundwater discussed in the site assessment section seems to have disappeared in the response action section. It should be noted that drinking water data in Florida should already be available. It is not at all clear from the strategy why these ARARs and the measurements to support them as described in tier-three are included for site assessment but play no part in response actions.

2. State and local control of indoor radon

Since much of the SSMB strategy was based on data collected by the agency in 1979, it was necessary to contact appropriate state personnel in Florida to determine relevant activities since 1979. Mr. Michael Gilley in Tallahassee, who directs the state's indoor radon program, indicated they had drafted legislation to establish acceptable indoor radon levels in homes in Florida. However, the legislation was never enacted into law thus making the states indoor radon control limits like those of EPA, simply guidance which is not enforceable. He also indicated that currently the main thrust of Florida's indoor radon program is focused on education of the public on the need for testing and referring the public to private sector companies for testing of their homes. He has recently had his indoor radon program staff reduced by half so there seems to be little likelihood of a more robust program in the near future.

3. State and local screening of land prior to development

Following EPA's 1979 report on radioactivity in reclaimed lands, Polk County health department personnel often performed gamma surveys on reclaimed land that was being considered for development. According to discussions with Mr. Harlan Keaton, the requests for these surveys from developers and the subsequent surveys were not required as a basis for obtaining a building or development permit and were only done on a voluntary basis. He was not aware of any land screening surveys currently being performed by county or state government entities. Legislation enacted by the state levied a charge per square foot floor area for new residential construction; however, these funds have not been directed to screening of reclaimed and mineralized land. Therefore, it is highly likely many new homes have been constructed on suspect lands since 1979, and according to Mr. Keaton residential construction is at a rapid pace in that area of central Florida.

4. Limitations of AMS

Aerial Measuring System (AMS) surveys provide a quick and comprehensive measurement capability to determine gamma exposure rates over large tracts of land. It has been used extensively at sites throughout the country and provides reliable data at a

relatively low cost per acre. Mr. Larry Zajac and Mr. Rich Vojtech from Bechtel were contacted to discuss applicability of AMS to the survey in the phosphate mining region. We questioned them regarding ability to resolve exposure rates on residential site parcels - typically $\frac{1}{4}$ to $\frac{1}{2}$ acre in size. Acknowledging that the background exposure rates in central Florida are relatively uniform and about $6 \mu\text{R/hr}$, they stated that it would be relatively easy to discern $20 \mu\text{R/hr}$ from background on residential sized parcels. They described it as looking much like a "flashlight on a field of black", indicating good resolution at these exposure rates. The strategy assumes that if AMS measures a parcel at $20 \mu\text{R/hr}$ or below, that a residence on this parcel would exhibit indoor exposure rates less than the measured outdoor exposure rate. This is normally the case due to the shielding afforded by a concrete slab underneath a residence; however, in EPA's 1979 report, 7% of 1,090 homes surveyed had indoor exposure rates higher than outside. This likely occurred because many of the measurements were at or near background of $6 \mu\text{R/hr}$ and statistical fluctuations of measurements played a role in the results.

Another limitation in the use of AMS for mass land screening is that it does not address two of the three ARARs, namely Ra-226 in soil and Ra-226 in groundwater. The measurement of gamma exposure rate by AMS will, however, help direct ground based sampling teams to sites likely to have soil concentrations approaching, or in excess of the soil radium ARAR.

5. Stakeholder Perceptions

A significant issue that surfaced in discussion with Mr. Keaton and Mr. Gilley was perceptions held by the public and by mining industry representatives of the problem and the governments addressing it. (These perceptions and problems were also very prominent in EPA's studies in the 1970's and early 1980's). The public, while hard to convince of health risks based strictly on calculations and lack of demonstrable health effects, is firmly convinced of adverse impacts on their property values. Mr. Keaton recalled a specific example that occurred in the Christina Bluffs subdivision in south Lakeland. Due to extensive EPA and state studies in this subdivision and the media attention drawn to the area because of the findings, homeowners and the development company saw a significant decline in sales and property values.

Mr. Gilley and Mr. Keaton both cited examples of the perceptions and influence of mining industry representatives. Even though the state was establishing an indoor radon control program and a land screening and building permit program to control future problems, these efforts were effectively tabled. It was further felt that public and mining industry representatives would respond negatively to renewed EPA measurement and remediation efforts.

V. Recommendations

1. Even though there may be limitations associated with the aerial survey, there is great benefit derived from being able to say that all 2,150 square miles has been screened. We recommend proceeding with plans to implement the AMS survey.
2. In the final analysis, using the UMTRCA ARARs could result in huge parcels of reclaimed land that would require remedial action. One strategy to limit this vulnerability is to seek waivers based on cost as a "technical" issue as described in the preamble to the NCP. Another technical issue may be the ability to measure 15mrem/year over background. This value equates to a gamma exposure rate of about 1.7 $\mu\text{R/hr}$, which may be indiscernible from statistical variation of the Florida background of 6 $\mu\text{R/hr}$, using conventional field measurement technology. We recommend that the "individual dosimetry" described in tier-three of the strategy be further defined as thermoluminescent dosimetry (TLD), and emphasized as the basis for making response action decisions. Thermoluminescent dosimeters are passive solid state gamma radiation detectors that are widely used for personnel dosimetry and for environmental gamma radiation monitoring. They are small, unobtrusive and are normally left in place to integrate gamma exposures for periods of three months or more. They are a simple, accurate and inexpensive means of characterizing gamma exposure fields.
3. We recommend identifying a much bigger role for the State to play in implementing the strategy. Our discussions with State personnel indicated at least an initial interest in a cooperative TLD survey.
4. The Department of Defense has developed comprehensive large-area radiation screening techniques based on in-situ measurements, which they have implemented in their base closure program. We recommend that Region IV review these techniques for possible applicability for tier-two assessment in this strategy. Steve Dean, EPA Remedial Program in Region IX is a good contact for this information.
5. We recommend that Region IV amend the strategy to promote the creation of incentives for state and local authorities to require screening of undeveloped land to minimize negative impacts from future development.
6. We suspect there have been changes in housing construction trends since the 1979 radon study which could materially change some of the assumptions (projections) underlying this strategy. We recommend that before the Region implements its strategy, that it examines these trends and makes adjustments to any impact projections. A shift toward a higher percentage of manufactured homes, for example, as opposed to slab-on-grade homes would result in higher indoor gamma exposures.
7. One of the most significant flaws in the current strategy is the assumption that the State has implemented radon control legislation that would control/reduce indoor radon risks. Since this is not the case, radon may represent a larger health risk than

the indoor gamma levels, and there is no ARAR for radon. We recommend that the Region amend the strategy to address the radon issue.

8. We think there may be merit in redirecting the Response Action section of this strategy towards Non-Time Critical Removal Actions to address the most hazardous locations identified in the assessment phases, and avoid an all-out internal confrontation over radiation cleanup levels. This may be particularly prudent since the Superfund role in mining operations is being re-evaluated at this time.

VI. Summary

The Region IV strategy for dealing with the Florida Phosphate Mining areas has been well thought out and constructed. The sections on risk versus the ARARs demonstrate a comprehensive understanding of the issues, and the discussion of cost as a technical basis for a waiver is a viable strategy. The framers of the strategy are to be commended.

We feel, however, that some of the key underlying assumptions used in the strategy are, or may be, incorrect.

The use of the aerial survey to compress the area of interest based on indoor gamma ARARs will not address soil concentration ARARs. There is no historical correlation between indoor gamma rates and soil radium concentrations, so it's entirely possible to rule out a parcel on the basis of indoor gamma, but fail to see a high soil radium concentration.

The State has not implemented administrative controls to address either radon levels in existing homes, or screening criteria for future development. The strategy, may, therefore be targeting the lesser of two health risks by incorrectly assuming the indoor radon risks are being addressed.

We were not able to discuss application of the ARARs with EPA Headquarters personnel, so we made certain assumptions regarding their views in making our evaluation. We will pursue a conversation with them as soon as possible to verify these assumptions.

Alternate Approach

We have devoted most of our efforts in evaluating the existing strategy in the light of its historic, technical and political approaches, and offered our recommendations on how to make it stronger.

We would also like to offer an entirely different approach for consideration:

1. Use land-based vehicle instrumentation and a MARSSIM-based characterization in situ sampling plan (like DoD at base closures) to identify impacted-vs-nonimpacted areas.
2. In cooperation with the State, conduct a 3-month TLD study of homes in the impacted areas.
3. Use the 20 μ R/hr indoor gamma level ARAR as a response trigger via Non-Time-Critical Removal Actions for Non-PRP sites. Offer PRPs the opportunity to do the same for their sites or proceed to NPL.
4. Wait to see what the current evaluation of the Superfund role in mining issues concludes, before defining final remediation strategy.

We have not researched the costs involved with conducting a MARSSIM-based characterization; however, we provided Region IV personnel with appropriate contacts to obtain additional information and cost estimates. If a Region IV cost evaluation indicates that the aerial survey screening as described in the existing strategy could materially decrease overall costs of our proposed alternate strategy, then it would be prudent to include the aerial survey as a prescreening tool.